

REMARKS

In response to the Official Action mailed on March 29, 2007, the application has been amended. No new matter has been added. Reconsideration of the rejections of the claims is respectfully requested in view of the above amendments and the following remarks.

On page 2 of the Official Action, claims 13 - 16 were rejected under 35 USC 103(a) as obvious over JP 08-001373 by Shozo Nagai et al (referred to below as Nagai). This rejection is respectfully traversed.

Claim 13 describes a lead-free solder alloy containing a nonzero Ni content of at most 0.3 wt %. Nagai does not disclose or suggest such a composition. As explained on page 5 of the amendment filed on November 22, 2006, Nagai discloses a brazing filler metal for use in brazing of stainless steel in a vacuum furnace without the use of flux which may contain 0.5 - 5.0 weight % of Ni. Nagai contains no suggestion of a Ni content of less than 0.5 weight % and in fact states, in paragraph 0008, that the addition of Ni has little effect when its content is less than 0.5 %, and Table 2 of Nagai shows that Comparative Example d had poor results with a Ni content of only 0.3 %.

While the Official Action acknowledges that Nagai does not teach a composition having a Ni content as set forth in claim 13, page 4 of the Official Action states that the composition of

claim 13 would nevertheless be obvious from Nagai because "the claimed ranges are close enough that one skilled in the art would expect them to have the same properties". In support of this proposition, the Official Action relies primarily upon *Titanium Metals Corp. v. Banner*, 227 USPQ 773 (Fed. Cir. 1985). However, reliance upon this case is misplaced. *Titanium Metals* relates to a situation in which a value specified by a claim falls between two acceptable values set forth in a reference, and the claim can be viewed as no more than an interpolation between the two known acceptable values. It does not relate to the situation in which the value of a component set forth in a claim lies outside the acceptable range taught by a reference, and in which the reference clearly teaches that the value set forth in the claim would be unacceptable. That is the situation with respect to claim 13, which specifies a Ni content falling outside the acceptable range set forth in Nagai.

If a person skilled in the art is to be expected to modify the teachings of a reference, there must be some advantage in his doing so. Otherwise, he has no motivation for the modification. The Official Action has not shown any advantage to modifying Nagai to employ a Ni content outside of the range which Nagai teaches, so a motivation for the proposed modification is lacking.

Therefore, as the prior art cited in the Official Action does not provide any motivation to modify Nagai to employ an Ni content of at most 0.3 weight % as set forth in claim 13, the rejection of claims 13 - 16 fails to set forth a *prima facie* case

of obviousness. Claim 13 and claims 14 - 16 which depend from it are thus allowable.

Dependent claim 15 further patentably distinguishes the present invention from Nagai by specifying that the P content is 0.001 - 0.01 weight %. As pointed out in the amendment filed on November 22, 2006, in Nagai, the lower limit for the P content is set at 0.05 %, and paragraph 0007 of Nagai states that P cannot exhibit the desired effects of exhibiting a self-fluxing action during brazing or improving wettability by breaking down a strong oxide film on the surface of stainless steel if its content is less than 0.05%.

In this regard, page 5 of the Official Action states that the composition in claim 15, despite having a P content well below the lower limit in Nagai, is nevertheless obvious because "that does not mean instant claimed 0.01 wt.% of P in claim 15 would have different properties of 0.1 wt.% P in instant claim 13." It is respectfully submitted that the Official Action is improperly using the Applicants' own claims as a basis for rejecting other claims. Each claim must be individually evaluated in its own right, and the allowability of claim 15 cannot be dependent on the different ranges being claimed in claim 13. Claim 15 needs to be separately evaluated as if claim 13 were not even present in the application. The question that needs to be asked is whether the range for P specifically set forth in claim 15 is suggested by Nagai, not the extent of the differences between claim 13 and claim 15. Since Nagai teaches

that the lowest level of P that provides satisfactory results in its invention is 0.05%, a composition having the much lower upper limit for P of 0.01 % cannot be obvious without a teaching or suggestion to lower the P content in Nagai below what it teaches is the lowest permissible level. As Nagai clearly prohibits a P content of less than 0.05 %, it provides no suggestion of a P content as set forth in claim 15.

Claim 16 further patentably distinguishes the present invention from Nagai by claiming a paste comprising the solder alloy of claim 13. As set forth on page 6 of the amendment filed on November 22, 2006, there is no suggestion in Nagai of using the brazing filler metal which it discloses in the form of a paste because Nagai repeatedly states that the purpose of its invention is to provide a filler material which can be used for vacuum brazing without a flux. Since the brazing filler metal of Nagai is not intended to be used with a flux, it is not intended to be used in the form of a paste, which entails the use of a flux.

In this regard, page 5 of the Official Action states that it would nevertheless have been obvious to have used the brazing material of Nagai as a paste, because Nagai states that its composition can be in the form of a powder, and Nagai also states that its composition can be used for brazing of materials other than stainless steel. However, it is well known to perform brazing using a powder without the powder being in the form of a paste. It is also well known to perform brazing of materials other than stainless steel without using a paste. In light of

the fact that Nagai states that its goal is to perform brazing without use of a flux, the mere fact that the brazing material can be in the form of a powder still would not suggest to a person skilled in the art that the brazing material be formed into a paste, since doing so would be contrary to the stated goal of Nagai. Thus, a person skilled in the art would have had no motivation to modify Nagai as proposed by the Official Action to result in the product of claim 16.

On page 3 of the Official Action, claims 17 - 19 and 32 - 36 were rejected as unpatentable over Nagai as applied to claims 13 - 16 and further in view of Gontier (U.S. Patent No. 4,858,816). This rejection is respectfully traversed.

Claims 17 - 19 and 32 - 33 are firstly allowable because they depend upon claim 13 and employ the solder alloy of claim 13. As set forth above, there is no suggestion in Nagai of a solder alloy having a composition as set forth in claim 13. Gontier is relied upon as teaching a soldering machine for use in soldering of a molten tin-containing solder alloy. However, Gontier does not disclose any specific solder composition, and in particular does not disclose a solder alloy as set forth in claim 13, so it does not make up for the deficiencies of Nagai in this regard. Therefore, even if Nagai were modified by Gontier as proposed by the Official Action, it would not result in a flow soldered joint or a flow soldering method as set forth in claims 17 - 19 and 32 - 33.

Claims 17 - 19 and 32 - 33 are further allowable because the

cited references do not suggest the specific use of a solder alloy set forth in these claims. Each of these claims relates to a method of flow soldering using the solder alloy of claim 13 or a product resulting from flow soldering using the solder alloy of claim 13. There is no suggestion in either of the cited references of using the brazing filler metal disclosed in Nagai for flow soldering and particularly for flow soldering of an electronic component. Gontier was relied upon in the Official Action as supposedly providing motivation to a person skilled in the art to employ the brazing filler metal of Nagai for flow soldering, but Gontier merely teaches a method of wave soldering using a wave barrier. As stated above, Gontier does not teach any specific solder compositions, and it nowhere suggests that every possible alloy is suitable for flow soldering. As such, there is nothing in Gontier to suggest using the brazing filler metal of Nagai for flow soldering.

As for Nagai, there is no disclosure of the exact method of brazing with which it is intended to be employed, and there is certainly no suggestion of using it for flow soldering, which is not a brazing method at all. In particular, Nagai contains no suggestion that it has any suitability for soldering of electronic components. Nagai repeatedly sets forth that its purpose is to braze stainless steel, that the brazing is performed in a vacuum, that the brazing is performed without use of a flux, and that the brazing is performed at a "low temperature" of 500 - 600°C. This temperature is 250°C or more higher than the maximum acceptable temperature for soldering of

electronic components to printed wiring boards. Even though paragraph 0004 of Nagai states that its object is to provide a brazing material with good wettability and flowability, these properties are exhibited in the range of 500 - 600°, and there is no indication that the brazing filler metal of Nagai exhibits these properties at the much lower temperatures at which flow soldering of electronic components must take place.

Page 5 of the Official Action states that paragraph 005 of Nagai teaches a composition with a fusing point as low as 232 °C, with the implication that the brazing material of Nagai is therefore suitable for flow soldering. However, what paragraph 005 of Nagai actually states in the original Japanese is quite different from the computer-generated translation available to the Examiner. In fact, the computer-generated translation of paragraph 005 bears little resemblance to the Japanese text. The following is a correct translation of paragraph 005 of Nagai by a professional translator in Japan:

[0005] The present inventors studied base elements and additional elements to be incorporated into a base element in order to discover an alloy composition for a brazing material having good wettability and with which it is possible to perform brazing of stainless steels having a tenacious oxide film on the surface thereof at a low temperature of 500 - 600 °C in a vacuum without using a fluxing agent. As a result thereof, we selected Sn as a base element. **This is because Sn has a melting point of 232 °C, which is the lowest among practical metals**, and a relatively low vaporization pressure which is between that of Ag and that of Cu. Sn

is also non-toxic, corrosion-resistant and stable in its price. Regarding additive elements, we also studied a variety of elements and found that when a small amount of P is added, a self-fluxing action thereof occurs during brazing to destroy a tenacious oxide film of a stainless steel member, resulting in an improvement in wettability. In addition, when Ni is added, the evaporation of P during brazing in a vacuum can be prevented to decrease pollution of a furnace and an exhaust system. Furthermore, when Cu or Ag can be added to improve flowability of the resulting brazing material during brazing. Cu and Ag can be added alone or together. The present invention was completed by defining the ranges of these additive elements in an alloy composition such that good wettability could be achieved during brazing at a temperature of 600 °C.  
(emphasis added)

Thus, paragraph 005 of Nagai does not state that the composition of Nagai can have a melting point of 232°C. Rather, it states that its composition employs Sn, which has a melting point of 232 °C, as a base element, i.e., as the primary component. As can be seen from Table 1 of Nagai, the very lowest liquidus temperature of the examples of Nagai is 300 °C, which is well above a suitable temperature for flow soldering. Table 2 of Nagai shows a comparative example (No. d) having a liquidus temperature of 230 °C, but this example, which has a composition falling outside the range taught by Nagai, has a very poor wettability as exhibited by the low value of 2.0 for the spreading coefficient W, so even the comparative example would be inappropriate for flow soldering.

Thus, neither reference contains anything to suggest that the brazing filler metal of Nagai is suitable for flow soldering of electronic components, and so there is no motivation to modify Nagai to perform flow soldering as set forth in claims 17 - 19 and 32 - 33. Accordingly, the Official Action does not set forth a *prima facie* case of obviousness of these claims. Claims 17 - 19 and 32 - 33 are accordingly allowable.

Independent claim 34 recites a soldering method for an electronic component employing a bath of a molten lead-free solder alloy. The composition of the alloy is similar to that set forth in claim 13, but it has a higher upper limit of 0.5% for the Ni content, which abuts the lower limit for the Ni content of the brazing material disclosed in Nagai. However, as set forth above, Nagai does not teach any brazing material having a liquidus temperature suitable for soldering of electronic components using a solder bath, nor does it contain any suggestion of the possibility of soldering of electronic components using its composition. Therefore, even if Nagai could be interpreted as teaching the alloy composition recited in claim 34, Nagai would still not suggest using such a composition for soldering of an electronic component with a bath of molten solder and therefore cannot render claim 34 or claims 35 and 36 which depend from claim 34 obvious.

Regarding claims 17 - 19 and 32 - 36, page 4 of the Official Action cited *In re LaVerne*, 108 USPQ 335 (CCPA, 1956) for the

proposition that "a use of a new material in an old patented process is not invention". This is one of those old adages, long defunct, which courts used to rely upon, but it does not represent the current state of patent law. *In re LaVerne* is not so much as mentioned in *Chisum on Patents*, the definitive work on modern patent law, and the Federal Circuit does not appear to have ever relied upon this case. It states a *per se* rule instead of relying on objective evidence, and it ignores the requirement that the prior art or the knowledge generally available to one skilled in the art provide some objective teaching that would lead a person skilled in the art to combine the relevant teachings of the references. *In re Fine*, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). An objective analysis of the references, as described above, shows that neither of the cited references contains any suggestion of modifying Nagai to employ the brazing alloys which it discloses for flow soldering. As such, they contain no teachings that could be combined to result in the methods or products set forth in claims 17 - 19 and 32 - 36.

On April 18, 2005, the Applicants submitted a declaration of commercial success concerning a solder alloy according to the present invention. On page 4 of the Official Action of June 22, 2006, the Examiner stated that the declaration of commercial success was deficient because it did not contain evidence that the sales of the product were solely because of the solder composition. In response, the Applicants are submitting with this amendment a further declaration concerning the commercial

success of alloys described by the claims of the present invention. This further declaration clearly shows that the excellent sales of these alloys is attributable to the properties resulting from the solder composition.

The new declaration is once again by Mr. Eietsu Hasegawa, who is one of the directors of Senju Metal Industry Co., Ltd. (the assignee of the present application) and the head of the sales department at Senju. The declaration shows that since the date of the previous declaration, sales have increased enormously. It also provides evidence that

- (a) Senju has no special advertising for the alloys according to the present invention,
- (b) the English and Japanese web pages of Senju are not believed to have had any effect on sales of these alloys,
- (c) Senju's sales force has not put any special effort on the sales of these alloys,
- (d) the alloys according to the present invention are being sold at substantially the same price as competitive products, so the excellent sales are not attributable to a discount price, and
- (e) the alloys according to the present invention have been accepted by the Japanese automotive industry, and in particular for use in the Prius Hybrid manufactured by Toyota, which is notorious for its strict demands concerning quality.

From these facts, it is clear that the excellent and increasing sales of the solder alloys according to the present invention are attributable to the solder composition itself and not to factors unrelated to its performance.

Taken together with the declaration under 37 CFR 1.132 by Mr. Yoshitaka Toyoda which was submitted on March 21, 2005 showing a long-felt, unsatisfied need for a lead-free solder alloy having good wettability comparable to that of a Sn-Ag-Cu alloy but having a lower cost, the declaration of commercial success attached to this amendment, which shows an immediate commercial success of the alloys according to this invention meeting this need, demonstrate the non-obviousness of a Sn-Cu-Ni-P alloy according to the present application.

New claims 37 - 41 describe additional features of the present invention. Each of these claims, which is allowable as depending from claim 13 or 34, includes the feature that the Cu content of the lead-free solder alloy is within the range of 0.3 - 1.5 wt %. A Cu content within this range provides unexpectedly superior wettability compared to solder having a Cu content outside this range. The inventors are in the process of preparing a declaration under 37 CFR 1.132 presenting experimental data showing the unexpected properties which are achieved in the claimed range for Cu. The declaration will be submitted to the Examiner as soon as it becomes available.

In light of the foregoing remarks, it is believed that the

present application is in condition for allowance. Favorable consideration is respectfully requested.

Respectfully submitted,



Michael Tobias  
Registration Number 32,948  
Customer No. 27649

1629 K Street, N.W., Suite 300  
Washington, D.C. 20006  
Telephone: (301) 571-0052  
Facsimile: (301) 571-0069  
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Attachment  
Declaration under 37 CFR 1.132